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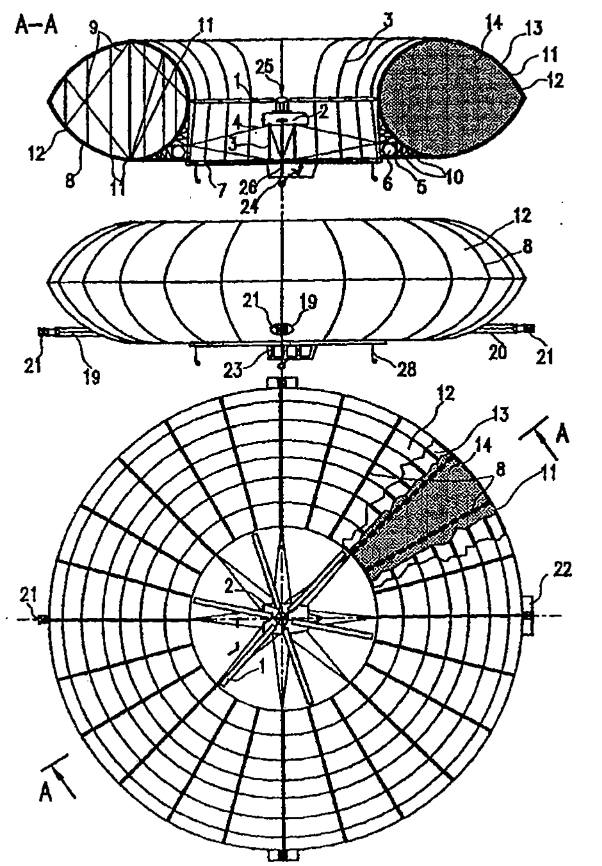
(54) Title: HYBRID TOROIDAL AIRSHIP

(57) Abstract

The invention relates to a flying apparatus for the purpose of lifting and carrying extremely large loads by air. The necessary lifting power is produced by the rotary wings situated in the centre of mass. The lifting force of the gas cells placed around the rotary wing and filled with helium keeps in balance with the self-weight of the flying apparatus. The transported load is carried by a gripping device or container placed underneath the centre of mass. The load is lifted by the necessary lifting force generated on the rotary wings. The rotary wings (1), connected to the circular girder (5) with the drive framework (3) and the tangent spoke or girder (4), form a flying unit with the gas cells (13) placed between the profile frame girders (8) departing from the circular girder (5) radially. The permanent moment of stability is ensured by a fluid gyroscope (7).



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HYBRID TOROIDAL AIRSHIP

The invention relates to a flying apparatus for the purpose of lifting and carrying extremely large loads by air. The necessary lifting power is produced by the rotary wings situated in the centre of mass. The lifting force of the gas cells placed around the rotary wing and filled with helium keeps in balance with the self-weight of the flying apparatus. The transported load is carried by a gripping device or container placed underneath the centre of mass. The load is lifted by the necessary lifting force generated on the rotary wings.

One of the solutions of the same character known so far is lifting the load directly with an airship body or gas balloon. In this case the size of the load to be lifted is restricted by the inefficiently huge dimensions of the airship body or gas balloon producing the necessary lifting force.

The load lifting capacity of helicopters with double gas turbine is rather significant. However, the size of the load to be lifted is restricted by the fact that apart from the load the helicopter must also carry its own structural mass.

The combined construction of an airship and a helicopter was created in order to overcome the above problems. As a known solution, underneath the spindle-shaped airship body four or more helicopters are fitted on girders on the side. The load is lifted by the joint dynamic lifting power of the helicopters. Here stability problems occurred because of the impossibility to synchronise the controlling of the helicopters.

The invention relates to a load lifting and carrying flying apparatus of compact construction, which is also suitable for independent operation. The rotary wings turning around the axis of the centre of mass and the load suspended under it increase the auto-stability of the system.

It functions on the basis of the same principle as the "Toroid gas cell airship with central rotary wing" described in patent No. P9700713 at the Hungarian Patent Office, but due to its structural construction the rotary wings can pull the soft torus-shaped gas cells to themselves, which may result in the destruction of the flying apparatus. In order to overcome this problem a rigid monocoque gas cell could be constructed which would cause a significant mass increase and it would result in volume and peripheral mass increase to the detriment of vibration strength. In the course of horizontal movement the torus-shaped gas cell has unfavourable aerodynamic characteristics.

The ducted fan steering and the horizontal and vertical barbs placed on the tail structure and the wing flaps of the radial girders described in the present registration, due to their delayed operation, do not prevent the airship body from pitching around the lateral axis. And the pitching movements are also needed for appropriately efficient aerodynamic steering. In strong wind and gusts it may result in the tipping over of the airship body. Joining airship bodies performing pitching movements above each other is risky and so it is not allowed. So the characteristics of the airship movement are described in the above registration.

The flying apparatus according to the invention manoeuvres avoiding pitching movements around the lateral axis typical of aeroplanes, helicopters and airships. So the rotation plane of the rotary wings is horizontal under all circumstances. It is ensured by highly efficient puff-pipe control and fluid gyroscope. Moving up and down functions along a vertical axis and turning left and right functions are possible. The horizontal movements forwards and backwards and right and left are crawling-type movements keeping the horizontal position of the rotor plane. The slot-controlled nozzles taken out over the contour of the gas cells serve as a gas rudder, and a compressor supplies them with the necessary amount of air. The positioning of the nozzles ensures the necessary steering moment in the appropriate plane. Permanent moment of stability is achieved with the fluid gyroscope. The fluid gyroscope is a pipe-ring with an arc returning into itself, in which high-speed fluid is circulated with the help of a pump. The moment of inertia of the fluid mass running on the arc has a stabilising effect on the flying apparatus.

The power units driving the rotary wings and the compressor are concentrated around the vertical axis of the centre of mass. From the supporting structure of these tangent spokes or braced girders are suspended to the circular girder connected to the gas cells. This circular girder is constructed like a pipe inside to transport the supply air of the gas rudders. This circular girder also carries the angle pipe of the fluid gyroscope.

From the circular girder complanar braced or pre-stressed frame girders depart radially. These frame girders are connected to each other with distance pieces with arch-concentric or spatial curvature. The circular girders and the distance pieces, covered with a casing, determine the external form of the flying apparatus. The radial slice shaped gas cell is situated underneath the casing, in the girder spaces. The control cabin is situated along the vertical axis of the centre of mass, under the lower plane of the gas cells.

By forming the profile of the radial frame girders even circular symmetric or optional streamlined bounding surfaces can be achieved.

Two constructions of the flying apparatus according to the invention are described. In drawing No. 1 and 2 the circular symmetric version with neutral blowing characteristics can be seen. The 2 driving unit of the 1 rotary wings is fitted on a 3 frame. The 3 frame is suspended with 4 spokes or girders to the profile 5 circular girder in the framework of which the circular 6 scaling tube of the gas rudders is situated. A 7 fluid gyroscope and its driving unit are fitted on the 5 circular girder. A profile 8 frame girder departs radially from the 5 circular girder. The 8 profile frame girder is a complanar supporting structure with pre-stressed arches and 9 bracing wires, or its is constructed as a simple braced girder. The 8 profile frame girders and the 10 consoles of the 5 circular girder are joined by arched 11 distance pieces. The 12 external casing put on them gives the form of the flying apparatus. The 13 gas cell constructed as a radial segment body can be placed in the space encircled by the radial 8 profile frame girders. After vacuuming, supplied with 14 gas filling, e.g. helium, at normal pressure the 13 gas cell can be connected to the girders.

The drive is fitted on the 3 framework near the centre of mass, the 15 compressor drive turns the ducted fan 17 compressor with the 16 distance axis, and the 17 compressor puts the 6 scaling tube of the gas rudders under the necessary overpressure. From the 6 scaling tube the force pipe 19 outlets of streamlined section, supplying the manoeuvring-stabilising 21 gas rudders branch off in the necessary directions. The force pipe 19 outlets encircle the 8 profile frame girder and they are connected to the undivided cross-sections with 18 bifurcated pipes. The 20 force pipe, which is also suitable for pushing operation apart from the stabilising-manoeuvring function, is provided with a greater cross-section behind the 17 compressor (17). At the ends of the force pipe 19 outlets projecting over the contour of the gas cells and gas rudder 21 panels of wing flap slot-control orientated in the necessary direction are situated. In the 21 panels the discharged air flow is turned by 22 guide louvres towards the direction of the controlled slot.

Near the centre of mass a 23 control cabin is suspended to the drive 3 framework. From the 23 control cabin a lower 24 holding unit can be operated serving for the purpose of holding a 31 load. The lower 24 holding unit is in direct connection with an upper 25 holding unit through the 26 bearing bar, which is led through the 1 rotary wing main axis, constructed like a pipe.

The flying apparatus lands with the help of the 27 main landing gear and the 28 supporting wheels, which also ensure moving and parking on the ground.

In drawings 3, 4, 5 and 6 a version is shown which is more favourable from the aspects of aerodynamics and has a smaller frontal area. In this case the structural construction is the same, except for that the size and the receiving space of the gas cells changes depending on the construction of the bounding surfaces. With respect to the main course this surface construction provides neutral aero-hydrodynamic characteristics. By adjusting the curvature of the lower and upper surfaces the bounding surface can also be set to produce lifting force in the course of horizontal movement.

In drawing 7, in order to increase the lifting capacity, three flying apparatuses are connected to each other with 29 lifting ropes or bars along the vertical main axis. The 31 load is held by a releasable 30 gripping device connected to the lower 24 holding unit. The connection between two flying apparatuses is ensured, at the bottom, by the releasable 30 gripping device holding the upper 25 holding unit placed at the lower end of the 29 lifting rope or bar, the connection to the upper 25 holding unit of the 29 lifting rope or bar is ensured by the releasable 30 gripping device connected to the 24 holding unit.

In drawing 8 the basic structure of the fluid gyroscope ensuring permanent moment of stability can be seen.

The moment of inertia of the 75 fluid mass forced to run on an arched course at a high speed in the full circle 71 force pipe is transferred to the plane determined by a 73 stiffening frame as moment of stability. A separate 74 driving engine drives the accelerator-circulating 72 pump, which keeps the 75 fluid mass moving.

CLAIMS

1. Flying apparatus with self-weight compensating radial gas cells around the rotary wing, **characterised by** that the rotary wings (1), connected to the circular girder (5) with the drive framework (3) and the tangent spoke or girder (4), form a flying unit with the gas cells (13) placed between the profile frame girders (8) departing from the circular girder (5) radially.

2. Apparatus as in claim 1, characterised by that the complanar profile frame girder (8) created as the continuation of the circular girder (5) and its consoles (10) and the gas cell (13) placed in the space between the arched distance pieces (11) holding them together provide optionally shaped radial surfaces.

3. Apparatus as in any of the claims 1 to 2, characterised by that the permanent moment of stability is ensured by a fluid gyroscope (7).

4. Apparatus as in any of the claims 1 to 3, characterised by that the moment of stability of a changing intensity and plane is ensured by a gas rudder panel (21) of wing flap slot-control, the force pipe (19, 20) of which projects over the contour of the gas cell.

5. Apparatus as in any of the claims 1 to 4, characterised by that the "circular scaling tube of the gas rudders" supplying the manoeuvring-stabilising force pipes (19, 20) is filled with the necessary amount of air by the ducted fan compressor (17) with distance axis drive (16) from the drive (15) placed near the centre of mass.

6. Apparatus as in any of the claims 1 to 5, characterised by that two or more flying apparatuses can be joined together by the gripping device (30) connected to the lower holding unit (24), gripping the upper unit of the lifting rope (29), and through the lifting rope, with the gripping device (30) placed at its lower end, gripping the upper holding unit (25) of the lower flying apparatus.

7. Apparatus as in claim 3, characterised by that the moment of inertia of the fluid mass (75) forced to run on an arched course at a high speed in the full circle force pipe (71) is transferred to the plane determined by the stiffening frame (73) as moment of stability. A separate driving engine (74) turns the accelerator-circulating pump (72) which keeps the fluid mass moving.

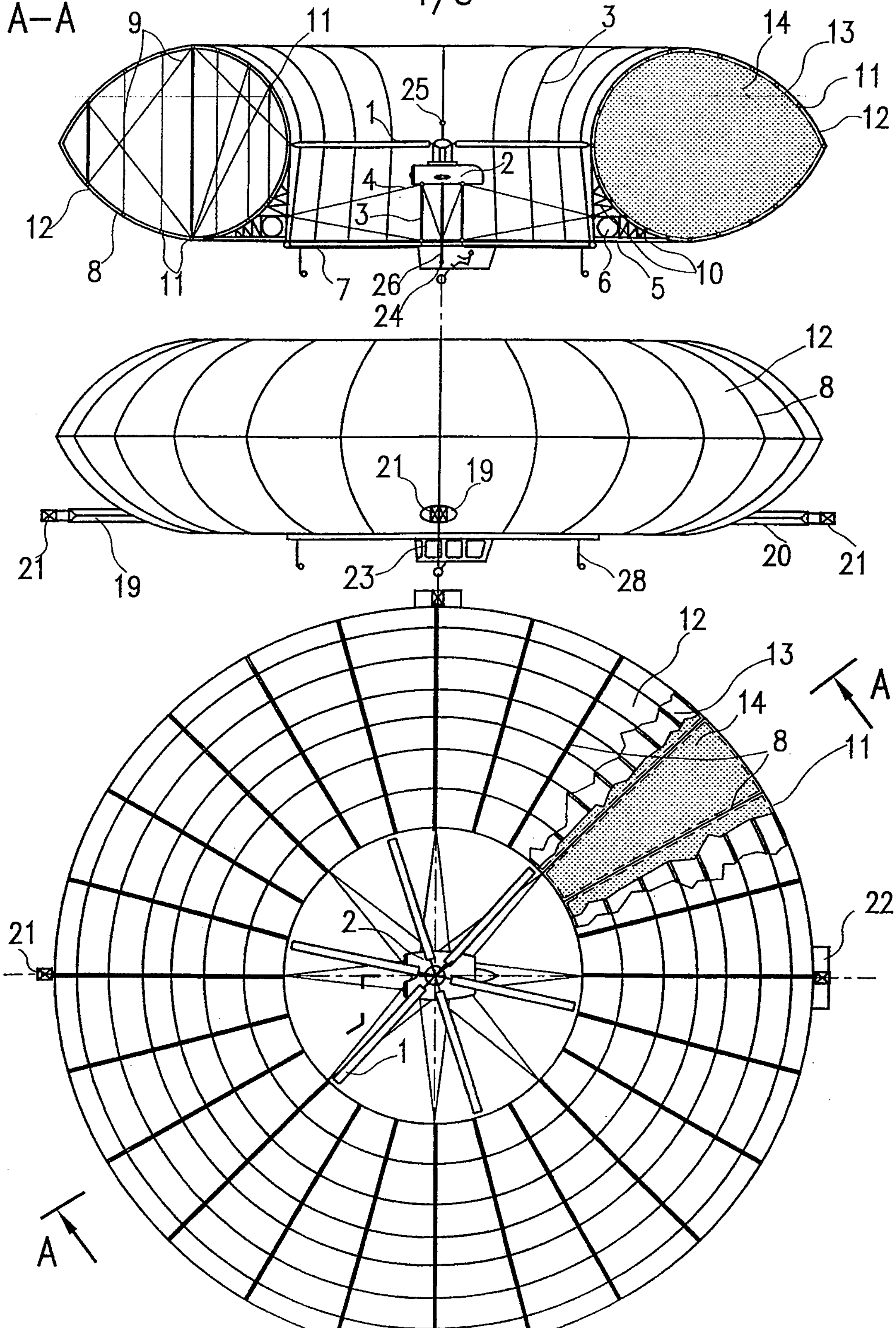
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Fig.1

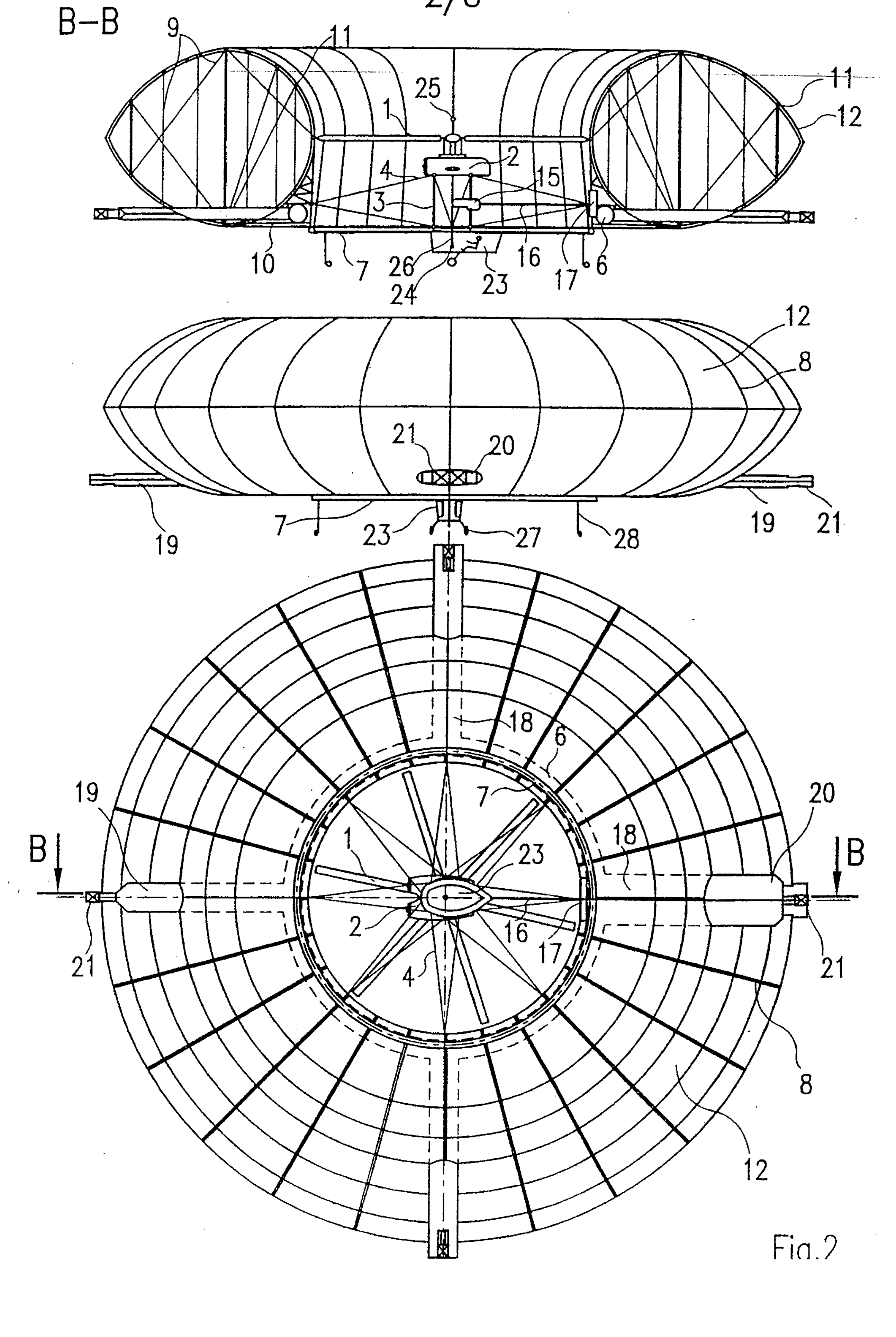
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Fig.2

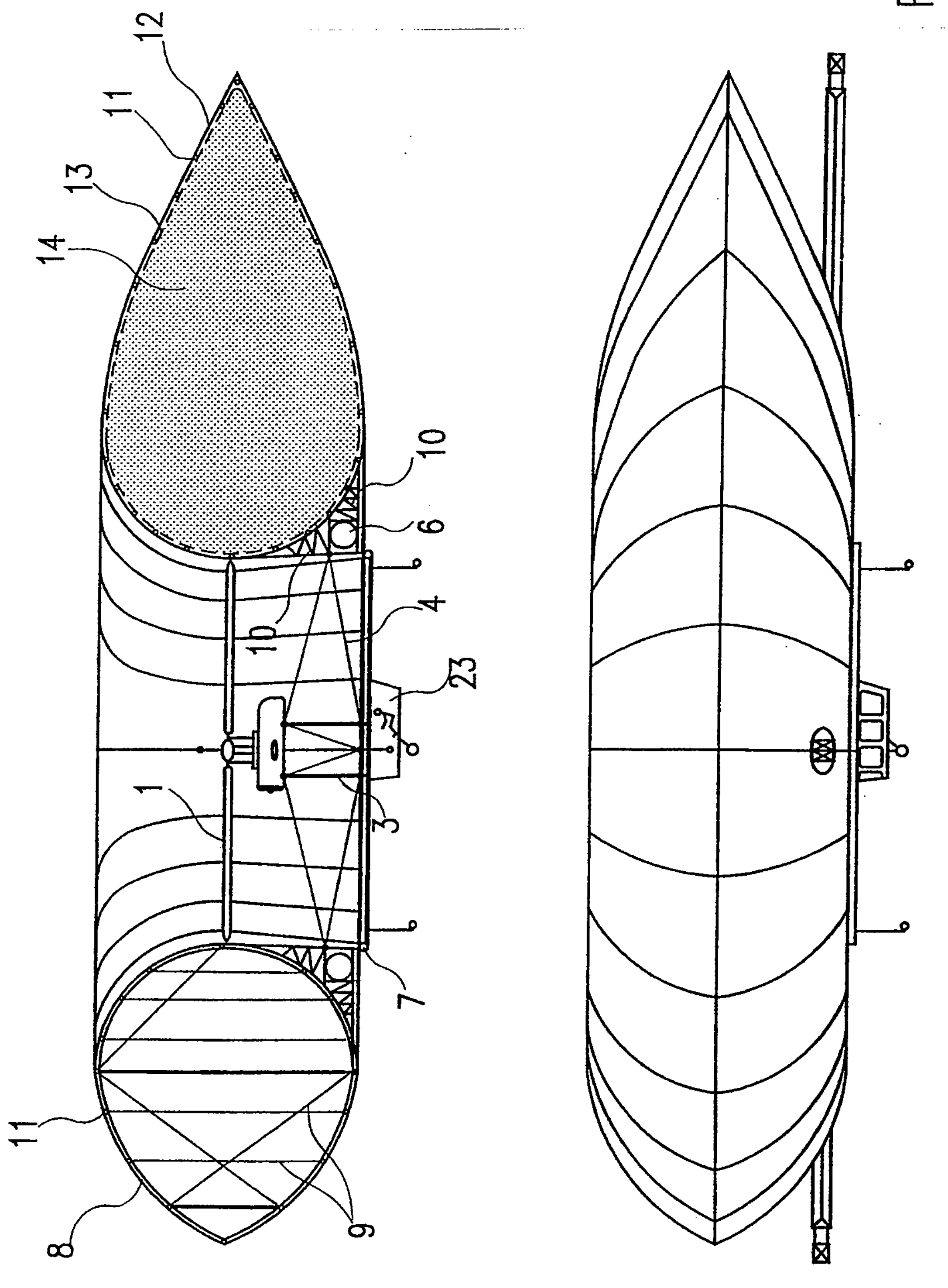

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Fig.3

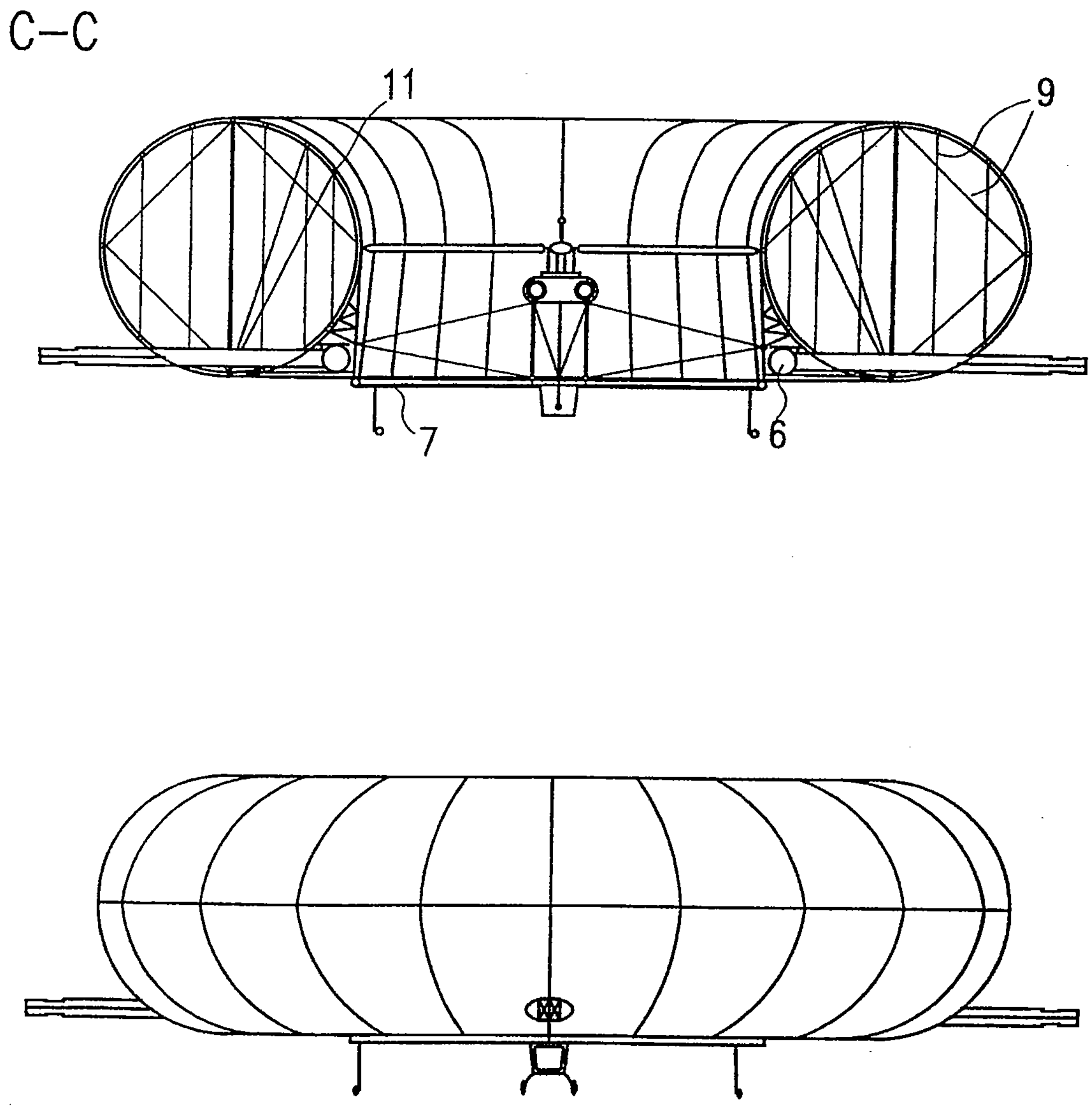

Fig.4

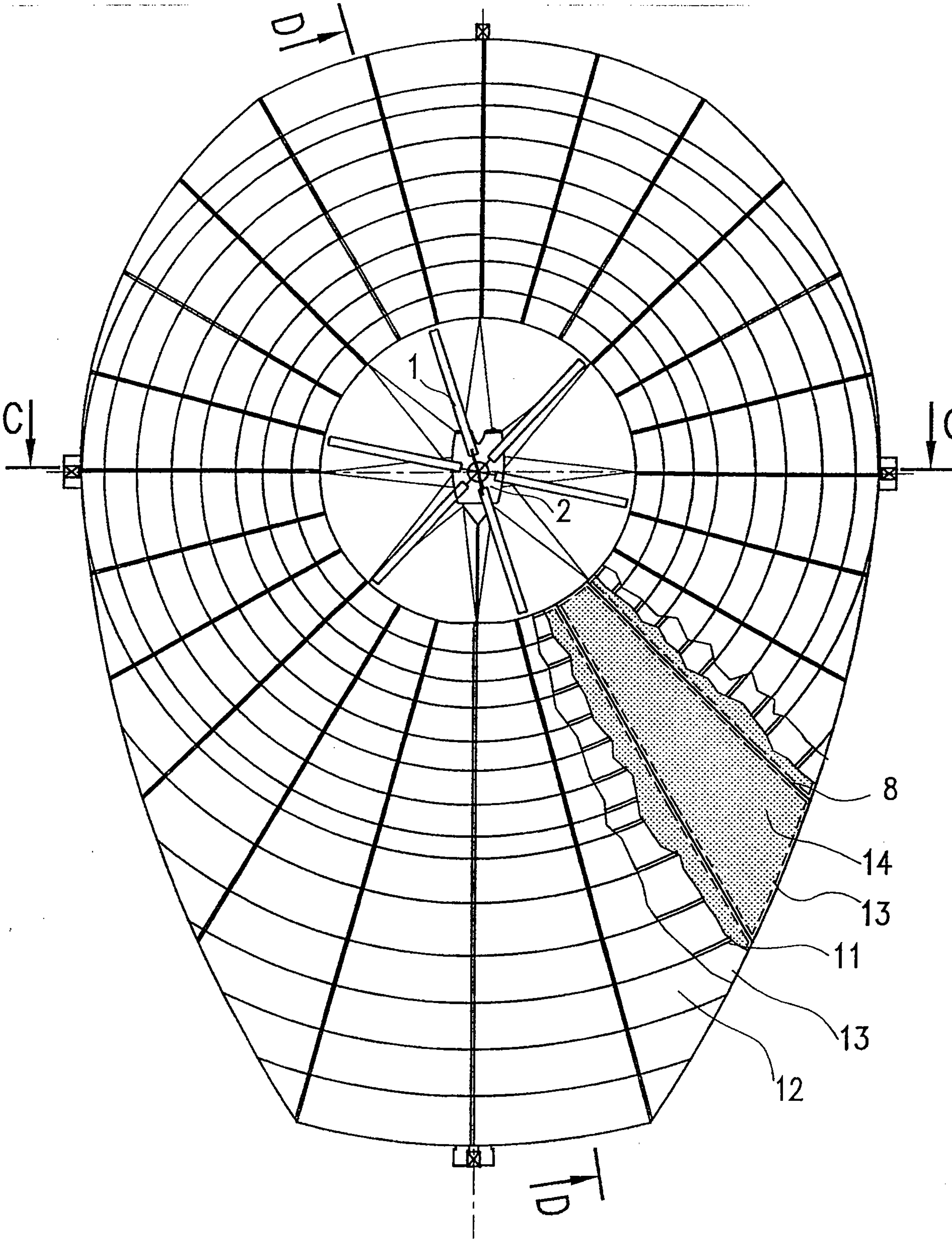

Fig.5

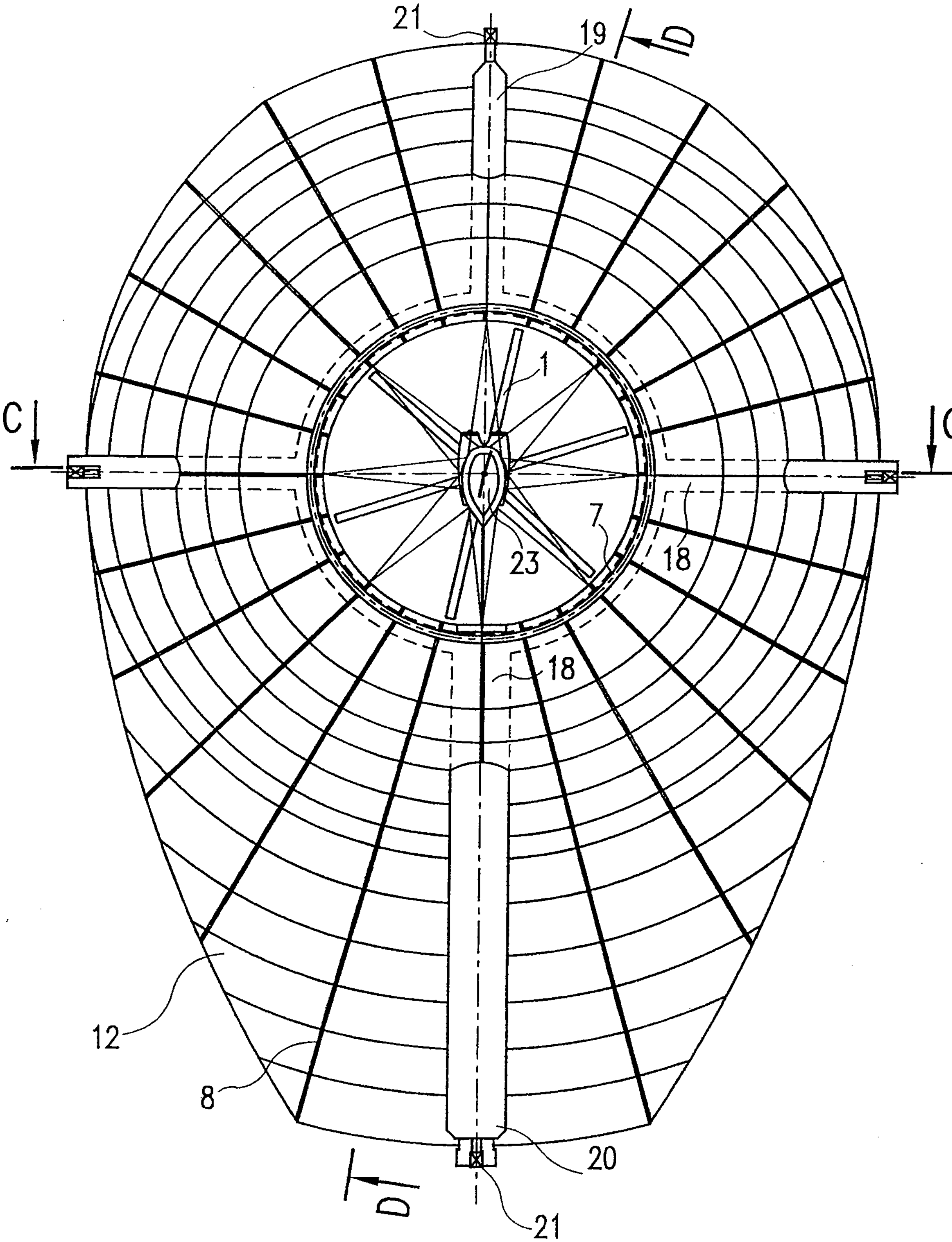

Fig.6

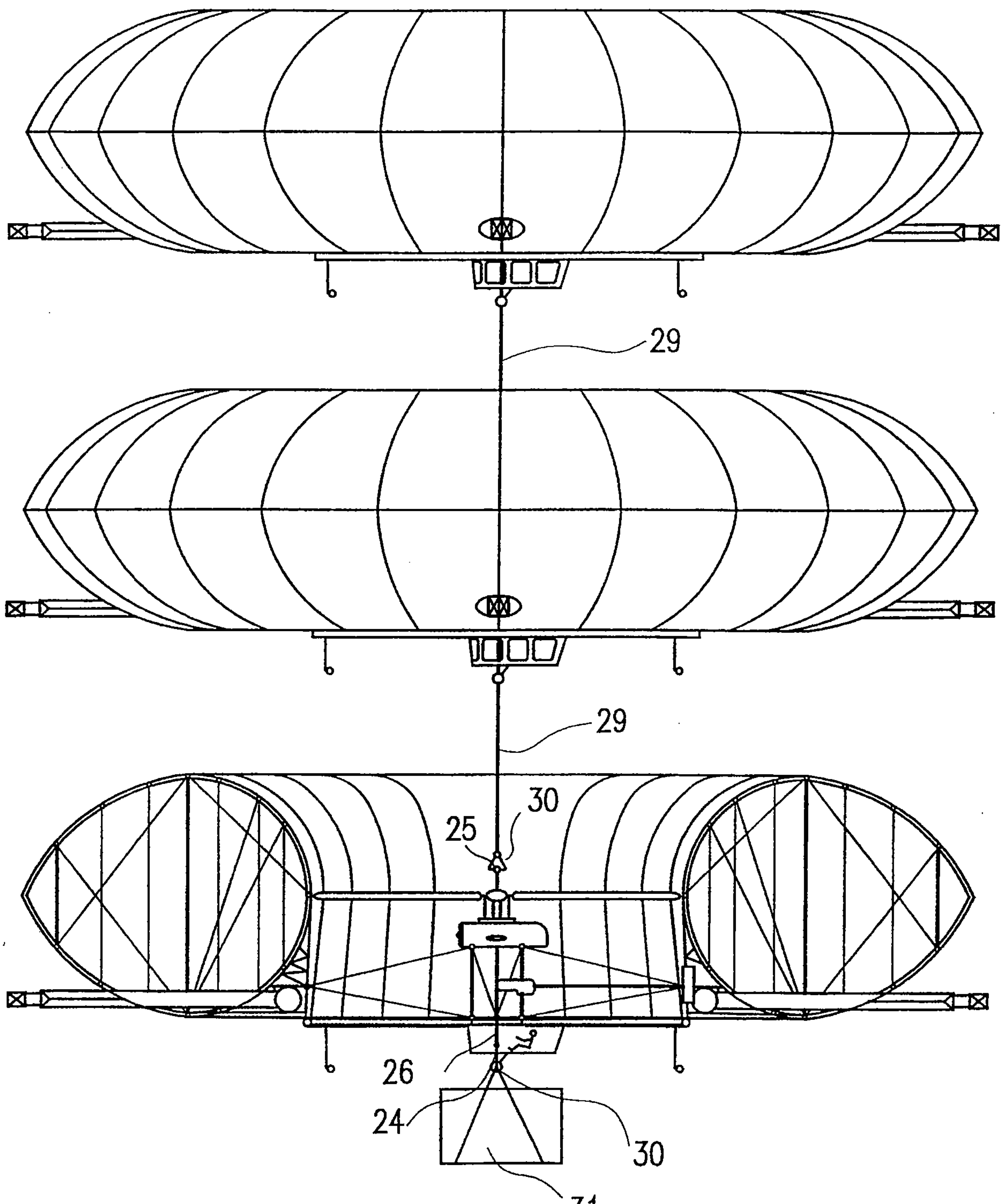

Fig.7

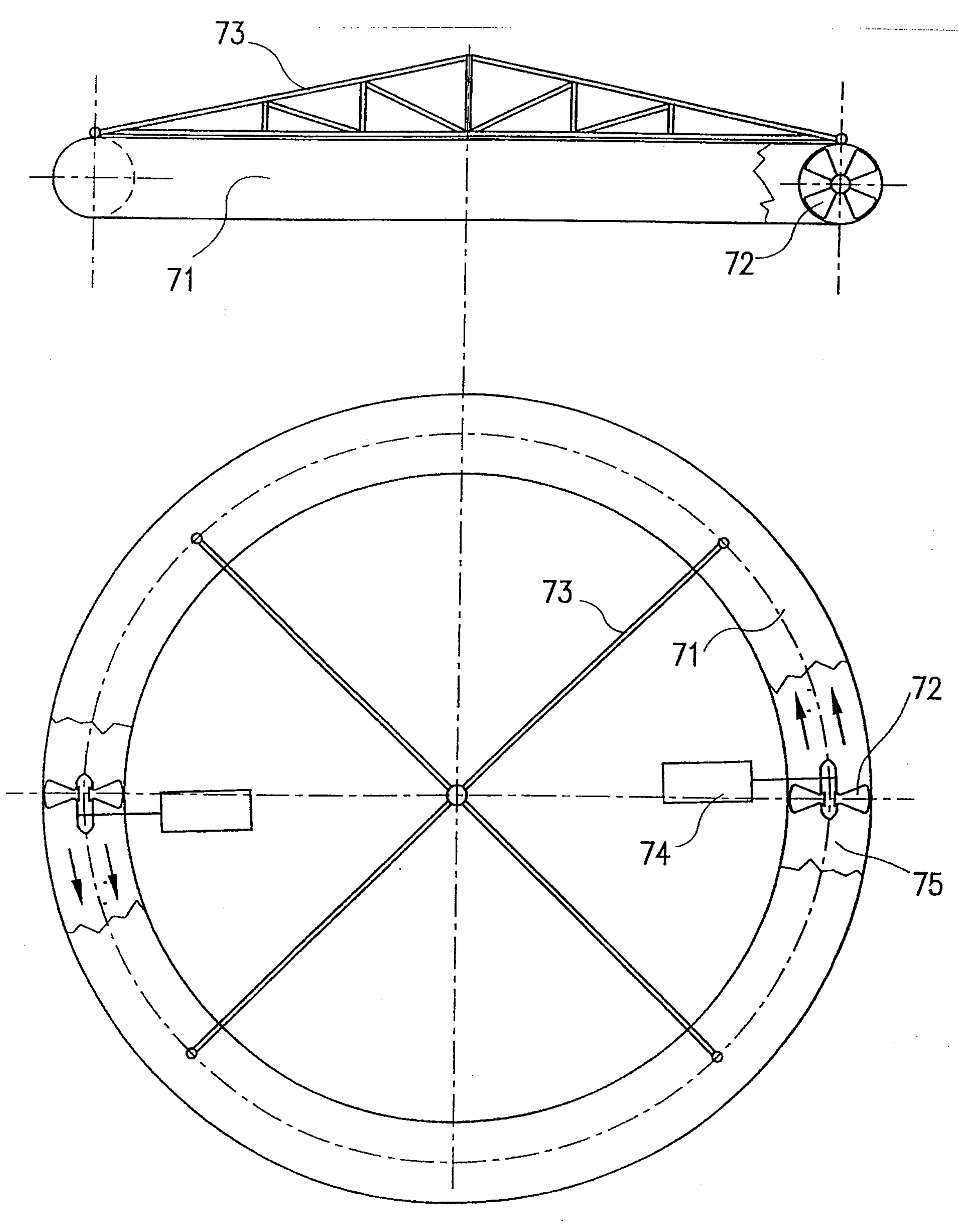

Fig.8

INTERNATIONAL SEARCH REPORT

International Application No
PCT/HU 99/00091

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B64C27/20 B64B1/06 B64B1/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B64C B64B B44C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 366 989 A (NAZARE EDGARD) 5 May 1978 (1978-05-05)	1
Y	page 2, line 21 - line 23	4-6
A	page 3, line 18 -page 4, line 11 figures	2
Y	US 4 606 515 A (HICKEY JOHN J) 19 August 1986 (1986-08-19)	4,5
A	column 2, line 56 -column 3, line 34 column 3, line 47 -column 4, line 46 figures	1
Y	GB 2 229 155 A (MIHAJLOVIC VLADIMIR) 19 September 1990 (1990-09-19) claims 1,2	6

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 March 2000	20/04/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Estrela y Calpe, J

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/HU 99/00091

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 201 309 A (HYSTAR AEROSPACE DEV CORP) 12 November 1986 (1986-11-12) page 17, line 5 -page 18, line 8 figures 8,9	1
A	US 3 083 934 A (E.G. VANDERLIP) 2 April 1963 (1963-04-02) figures	1,2
A	US 4 114 837 A (PAVLECKA VLADIMIR H ET AL) 19 September 1978 (1978-09-19) figures	1,2
A	US 4 023 751 A (RICHARD WALTER A) 17 May 1977 (1977-05-17) column 1, line 28 - line 37 figure 4	3,7

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International application No.
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INTERNATIONAL SEARCH REPORT

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/ HU 99/00091

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1,2
Structure for a flying apparatus consisting of a toroidal gas cell and a rotary wing.

2. Claims: 3,7:
Fluid gyroscope for stability of flying apparatus

3. Claim: 4,5:
Attitude control system for flying apparatus consisting of blown fluid through a pipe with a rudder at its end.

4. Claim: 6

Gripping device for connecting two or more of such flying apparatus

[redacted] [redacted] [redacted]

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/HU 99/00091

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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